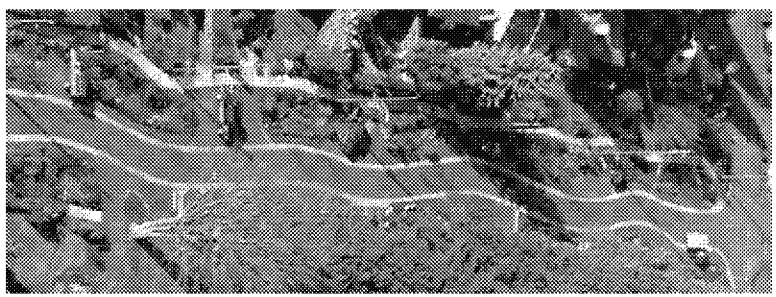
Portland, Oregon

As in most urbanizing areas, Portland's increasing development has led to greater volumes and velocities of stormwater runoff, which has threatened critical waterways. Combined sewer overflows have also decreased water quality in the region. In search of methods to alleviate these environmental strains, the City of Portland Bureau of Environmental Services analyzed the key ecosystem benefits of replacing traditional grey infrastructure with green infrastructure in their ten year "Grey to Green" program, which encourages innovative stormwater management.

In addition to ecosystem benefits, the city has begun to research the many additional social and economic benefits that GI can provide. For example, in its "Energy and Greenhouse Gases" section, the report calculates the energy savings from the Grey to Green's proposed 43 acres of green roofs. The calculations estimate an annual savings of 63,400 kWh (ENTRIX 2010). The next step would be to translate this energy-savings benefit into a monetary value by multiplying by a price per kilowatt-hour. While as yet no monetary value has been assigned for these benefits, the city is working toward a better understanding of the underlying additional value green infrastructure can provide its communities.

Seattle, Washington

Since the late 1990s, the Seattle Public Utilities (SPU) agency has undertaken a variety of green infrastructure pilot programs including the well-known Street Edge Alternative (SEA) project. This and similar programs aim to reduce and treat runoff impacting water quality and aquatic habitat in the Puget Sound watershed by managing stormwater more effectively at a localized level. With this and other pilot programs, Seattle has collected performance data and made the case for substituting green infrastructure practices for traditional grey infrastructure in urban and suburban areas. For example, SPU estimates that a local street converted to the SEAStreet design saves $100,000 per block (330 linear feet) compared to a traditional street design, while achieving the same level of porosity (35 percent impervious area). In addition to these avoided-cost savings, the program claims these designs have provided additional community benefits such as traffic calming, improved neighborhood aesthetic and bioremediation (SPU 2010).



For more examples of communities implementing green infrastructure practices, please check-out The Conservation Fund's Green Infrastructure Leadership Program, which has assembled an online database of green infrastructure projects being planned and implemented across the country.
http://www.greeninfrastructure.net/content/projects

Conclusion

This guide distills some of the considerations involved in assessing the financial viability of common green infrastructure practices that are gaining ground in municipal water management. It aims to assist decision-makers in evaluating options and deciding where, when and to what extent green infrastructure practices should become part of future planning, development and redevelopment within communities.

In clarifying how to assign value to potential green infrastructure benefits, the guide begins to describe and demonstrate a process that works toward estimating the monetary value of GI, when possible, through the following steps:

Step 1: Quantification of Benefit
Step 2: Valuation of Quantified Benefit

By dividing this process into the above steps, this handbook allows for the cumulative assessment of the values associated with these practices. Clarifying these steps enables decision-makers to develop a better understanding of the potential benefits green infrastructure investments can provide their communities.

The field of green infrastructure and its valuation is still developing. Challenges in assigning value still exist. The following list outlines critical next steps in fully realizing the values of green infrastructure in the market place:

- More research regarding the social benefits of GI in order for these types of values to be included in the overall monetary valuation process
- A full life cycle analysis to recognize the long-term value of potential GI programs in municipal budgeting and infrastructure decisions
- Further development of tools, such as CNT's GreenValues Stormwater Calculator, to include the monetary benefits of GI in benefit-cost analysis
- Valuation of a range of GI practices beyond the five common practices listed in this guide
- Increased availability of local and regional data and modeling to more accurately assess the valuation of GI practices within a particular area
- The ability to better scale up the benefits of a proposed GI program in order to develop a clearer picture of the municipal or regional impact such practices can have on community's quality of life

While the above steps will help to improve the range and accuracy of benefit calculations from GI practices, the "Case Study" section demonstrates the growing trend of green infrastructure adoption throughout the country. Decision-makers are coming to understand the full range of infrastructure choices available to them. Recognizing green infrastructure's benefits will help municipalities make choices that not only provide solutions to urban stormwater management issues but also bring a plethora of additional benefits to their communities.

Appendix A

CNT's Green Values® Calculator
http://greenvalues.cnt.org/national/calculator.php

CNT's Green Values Calculator™ is a tool for quickly comparing the performance, costs, and some benefits of green infrastructure practices to those of conventional stormwater management practices. The GVC takes users through a step-by-step process of determining the average precipitation at the site, choosing a stormwater runoff volume reduction goal, defining the impervious areas of the site under a conventional development scheme and then choosing from a range of green infrastructure best management practices (BMPs) to find the combination that meets the runoff volume reduction goal in a cost-effective way. The calculator provides construction, annual maintenance and lifecycle (NPV) cost comparisons to manage a specified volume of stormwater for green infrastructure and conventional scenarios. The calculator also estimates some of the non-hydrologic benefits of using green infrastructure.

GreenSave Calculator
http://www.greenroofs.org

The *GreenSave Calculator*, developed by Green Roofs for Healthy Cities and the Athena Institute, allows for the analysis of various roof types over a set period of time in order to compare life-cycle costs. The tool is intended to help users examine future operating, maintenance, repair or replacement costs, as well as benefits such as energy savings. This enables users to determine whether higher initial costs are justified by reducing future costs. It also makes it possible to determine whether some roofs have lower initial costs that may increase over time.

Urban Forest Effects Model (UFORE)
http://www.ufore.org/

The UFORE model, developed by United States Department of Agriculture Forest Service researchers at the Northeastern Research Station in Syracuse, New York, is able to provide detailed, locally specific results regarding the air quality, building energy, greenhouse gas emissions, carbon storage and sequestration impacts of the existing urban forest. The model does, however, require substantial field data collection by users.

Street Tree Resource Analysis Tool for Urban Forest Managers (STRATUM)
http://www.fs.fed.us/psw/programs/cufr/stratum.shtml

Like the UFORE model, STRATUM, developed at the Center for Urban Forest Research at the Pacific Southwest Research Station of the US Forest Service, uses field data collected by the user in order to model tree impacts. Unlike UFORE, STRATUM is designed to assess not the entire urban forest but street trees in particular. The model not only quantifies benefits but also includes costs, making it more applicable as an asset management tool. In addition to quantifying and valuing the energy conservation, air quality improvement and

climate benefits of trees, STRATUM also includes stormwater management benefits and property value impacts.

i-Tree Software Suite
http://www.itreetools.org/index.php

The i-Tree Software Suite from the USDA Forest Service is a helpful tool for analyzing and assessing the benefits of urban trees. Developed by adapting both the UFORE model (in i-Tree Eco) and the STRATUM model (in i-Tree Streets), the suite examines the pollution mitigation, reduction of stormwater run-off, and carbon sequestration benefits of urban trees.

The National Tree Benefit Calculator
http://www.treebenefits.com/calculator/

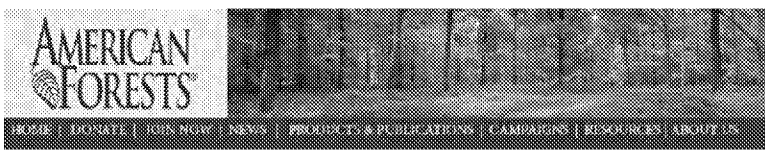
Casey Trees and Davey Tree Expert Co. have developed a National Tree Benefit Calculator which allows users to determine the stormwater, property value, energy (both electricity and natural gas), air quality and climate benefits and values for an individual tree. Users are required to input a zip code, the tree species, the tree's diameter and the land-use type.

Green Roof Energy Calculator
http://greenbuilding.pdx.edu/test.php#retain

The Green Building Research Laboratory at Portland State University is developing an online calculator to allow users to compare the energy performance of a building with a green roof to the performance of the same building with a conventional (black) or high-albedo (white) roof. Users input building location, roof area, and building type information, as well as green roof growing media depth and leaf area index. Users also have the option of inputting their own utility cost data or accepting default values. The calculator returns comparative annual electricity and natural gas consumption and total annual energy costs for the three roofing scenarios.

Low Impact Development Rapid Assessment Tool (LIDRA 2.0 model)
http://www.lidratool.org/

The Low Impact Development Rapid Assessment Tool is a model designed to compare the life-cycle values of implementing various green infrastructure techniques used in reducing runoff versus conventional stormwater management practices. The tool pulls from a database of performance and cost values derived from national data.



CITYgreen
http://www.americanforests.org/productsandpubs/citygreen/

American Forests' CITYgreen is an extension of ESRI's ArcGIS software. It converts stormwater and energy impacts (among others) from trees and other vegetation into monetary values based on local specifications.

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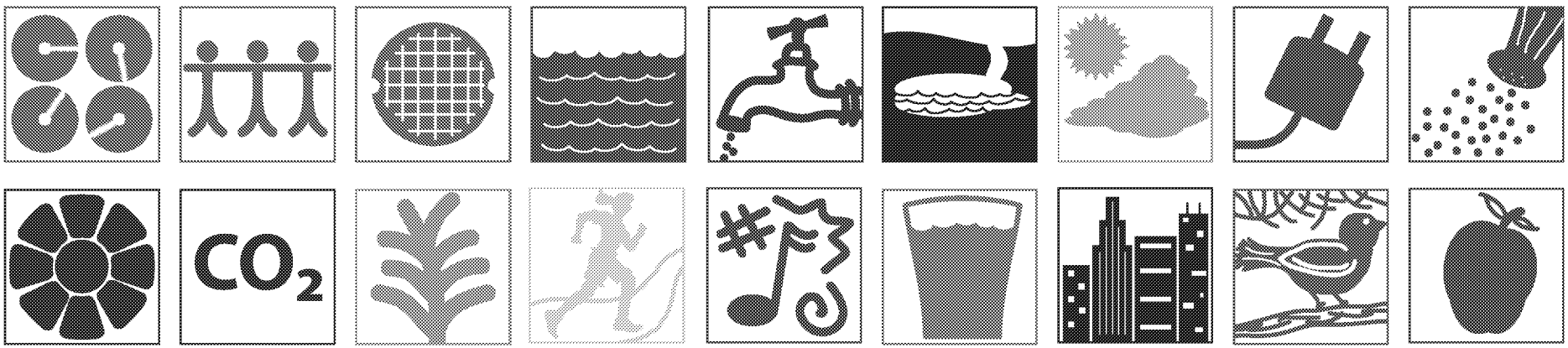

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